Comparative study of EDS and WDS for quantitative microanalysis

Chen, J.[1], Chen, H.[1] and Brink, F.[1]

[1] Centre for Advanced Microscopy, The Australian National University, Australia

Microanalysis using EDS (Energy-dispersive X-ray Spectroscopy) and WDS (Wavelength-dispersive X-ray Spectroscopy) has been widely applied to determine the chemical composition of solid materials. It is a common misconception that WDS analysis produces far superior quantitative results with higher precision and accuracy compared to quantitative analysis performed on any EDS system. One contributing factor to this belief may well be due to the fact that many EDS systems appear to promote a "standardless" approach when performing quantitation. In truth, the quality of the analysis largely depends on factors such as sample preparation, calibration procedure and analytical conditions rather than how X-rays are detected. This study will focus on the analysis of several materials with known compositions which have been analysed by using both the WDS and EDS approach. Careful calibration, using well characterized standard reference materials were performed for both WDS and EDS. The analytical results obtained are compared and discussed to demonstrate the advantage and disadvantage of each approach.

A number of materials with known compositions including oxide, sulphide and alloys were mounted in epoxy resin and grinded/polished down using 1m diamond particle suspension. The samples then were carbon coated to obtain a coating thickness of ~20nm. Appropriate standard reference materials were selected for elements to be measured. The Jean-Louis Pouchou and Francoise Pichoir (XPP) method was applied for matrix correction for both WDS and EDS. WDS analysis was carried out on JEOL 8530F plus Hyperprobe and EDS analysis was performed on Hitachi 4300 SEM with an Oxford X-Max 80mm^2 SDD EDS detector and Oxford INCA software.

In the present study, EDS analysis has been demonstrated to be able to measure major element compositions at a quantitative level with accuracies equivalent to WDS measurements, Since EDS generally requires much lower probe current than WDS, this helps minimize the uncertainties caused by damage in beam sensitive samples. WDS analysis, on the other hand, is to be preferred for reliable minor and trace elements analysis, owing to its much higher signal to noise ratio at elevated probe currents.